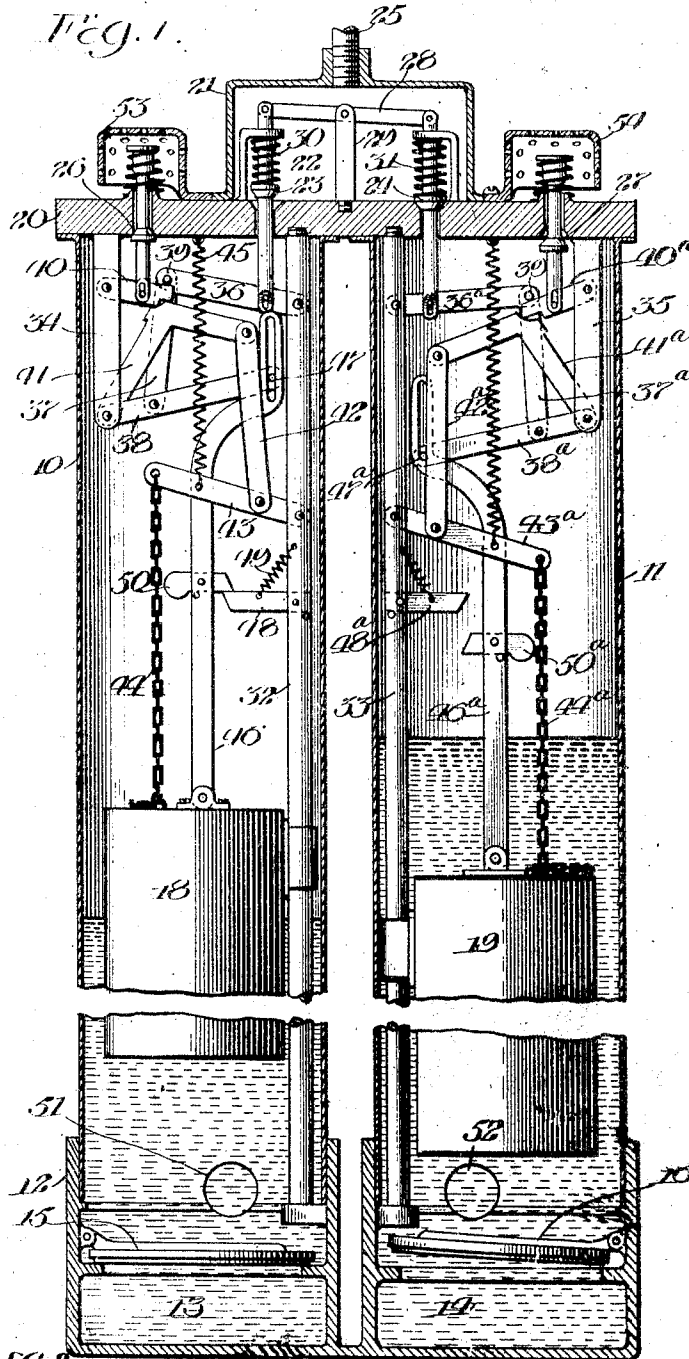


M. S. SWANSTROM.
PNEUMATIC PUMP.
APPLICATION FILED JULY 18, 1910.

1,039,842.

Patented Oct. 1, 1912.

2 SHEETS-SHEET 1.



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3 SHEETS-SHEET 2.

Fig. 2.

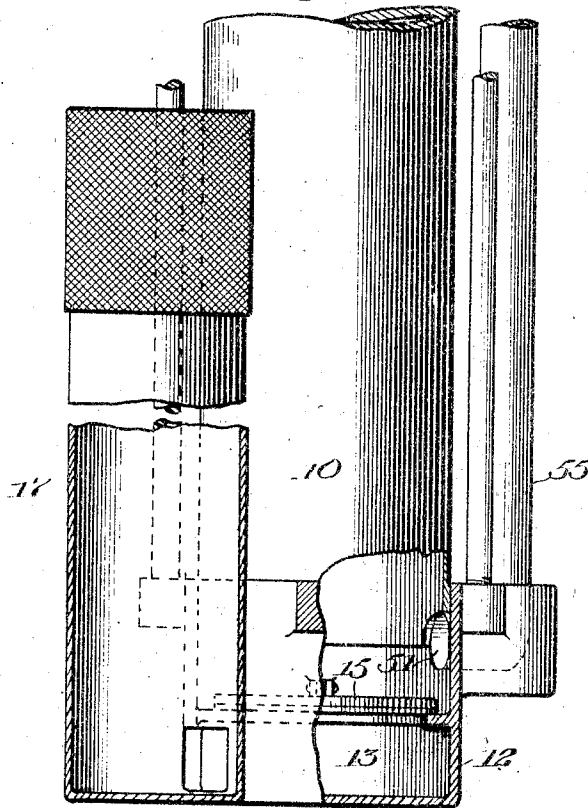
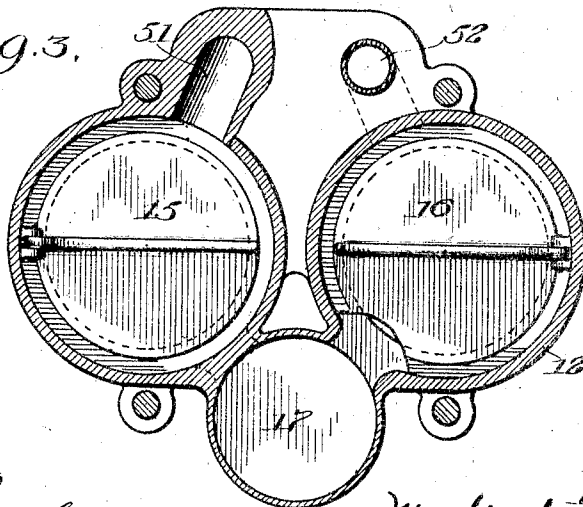


Fig. 3.



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PNEUMATIC PUMP.

1,039,842.

Specification of Letters Patent.

Patented Oct. 1, 1912.

Application filed July 18, 1910. Serial No. 572,458.

To all whom it may concern:

Be it known that I, MARTIN S. SWANSTROM, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Pneumatic Pumps, of which the following is a specification.

My invention relates to pneumatic pumps and has for its object improvements in pumps of that kind.

It is a common practice to use wind-mills or other sources of power to pump water from wells, cisterns or other supplies of water into an elevated tank or reservoir from which place water is permitted to run by gravity to the places desired. One of the objections to this form of water supply for residences and other places is that the water stored in such a tank or reservoir for any length of time becomes heated in summer or frozen in winter. Also water which stands in a reservoir in that way becomes stale and slimy and generally unfit for use. Another manner of proceeding in supplying water is the use of the wind-mill or other sources of power to run an air compressor and force air into a reservoir where it is maintained under pressure. From here air is conveyed by suitable pipes to a submerged pump and the compressed air used to operate the pump. In this system, the water supplied is always fresh from the source. The pump herein shown and described is one suitable to be operated in this latter way, and is shown of narrow and long form so that it may be easily inserted in a well of comparatively small diameter and submerged to or near the bottom of the well.

In the accompanying drawings Figure 1 is a central longitudinal section of the pump showing the same in elevation; Fig. 2 is an irregular section for the purpose of showing some parts not clearly shown in other views, and Fig. 3 is a plan partly in section of the base of the pump.

In the said drawings 10 and 11 are two chambers in the form of cylinders which set into a base 12. The lower part of the base 12 is provided with two chambers 13 and 14 which have openings extending upward and closed by valves 15 and 16. Chambers 13

and 14 are intake chambers through which water flows upward into the pump chambers 10 and 11. At one side of the base 12 is an intake passage-way 17 which extends upward by the side of the pump chambers 10 and 11 and which has openings from the lower portion into the intake chambers 13 and 14. (See Fig. 3.)

Inside the chambers 10 and 11 are floats 18 and 19. These floats are somewhat heavier than ordinary floats, so that when out of water they will weigh considerable. The exact weight of these floats is not material, but for convenience it will be assumed that they and their connected parts weigh about one half as much as the water which they displace. These floats control valves as will be hereinafter described.

The tops of the chambers 10 and 11 are closed by a cover 20 and over this cover is another cover 21 which provides an interior or supplementary chamber 22. Through the top 20 are inlet openings which are closed by the valves 23 and 24. These valves and the openings are inside of the supplementary chamber 22. At the top of this chamber 22 is a pipe 25 through which compressed air from the storage reservoir is conveyed to the supplementary chamber 22. Also in the top 20 but outside of the supplementary chamber 22 are openings closed by exhaust valves 26 and 27. The valves 23 and 24 are connected together by cross piece 28 supported in a post 29 and so arranged that when one of these valves is open the other is closed. Springs 30 and 31 normally act to push these valves 23 and 24 to their seats. The inlet valves and exhaust valves have stems extending inward to certain links and levers which will be hereinafter described.

Secured to the cover 28 are downwardly projecting posts 32 and 33 extending inside of the chambers 10 and 11. Also secured to the cover 20 are two other posts 34 and 35. These various posts serve as pivoting supports for the links and levers before mentioned. For convenience of description the water line is shown in both of these chambers 10 and 11. In chamber 10 the water has fallen far enough so that the float 18 has at the position shown a downward pressure on connections hereinafter to be described.

In the cylinder 11 the float 19 is shown totally submerged and consequently has an upward pressure on its links and levers.

The links and levers in both of the chambers 10 and 11 are alike, hence for convenience I will describe those in chamber 10, it being understood that those in chamber 11 are of the same form but are in a different position. Pivoted on the post 32 is a lever 36 which is connected at its outer end to a link 37 and at an intermediate point to a stem projecting downward from the valve 23. The lower end of the link 37 is connected to another lever 38 which is pivoted at the lower end of the post 34. The pivoting pin 39 between the lever 36 and the link 37 extends laterally and rests upon the upper part of a short lever 40 which is also pivoted to the post 34. The exhaust valve 26 has a stem extending downward and connecting to an intermediate part of the lever 40. Pivoted to the post 34 at the same place at which the lever 38 is pivoted is also pivoted another lever 41 which is in the form of a bell-crank and has a link 42 connected to its outer end. The lower end of the link 42 is connected to a lever 43 which is also pivoted to the post 32. The outer end of the lever 43 is connected to a chain 44 which is ordinarily slack. The upper corner of the bell-crank lever 41 is curved in cam shape and just beyond this curved part is a flat portion or seat which serves as a support for the lever 40 to prevent the said lever descending until the bell-crank lever has moved out of the way as will be hereinafter described. A spring 45 normally acts on the lever 43 and through the link 42 to hold the bell-crank lever 41 in a position to act as a lock to prevent the descent of the lever 40.

Secured to the upper part of the float 18 is a standard 46, the upper end of which is slotted and engages a pin 47 in the outer end of the lever 38. Pivoted to the post 32 is a short lever 48 normally held in the position shown by spring 49. Pivoted on the standard 46 is a short lever 50 which is adapted to engage the upper part of the lever 48 when the float 18 descends. The tension of the spring 49 acts to prevent the float 18 moving downward until the water has moved far enough down to expose nearly all of the float 18. As the water moves downward, increased weight thrown upon the spring 49 finally permits the lever 48 to move downward far enough for the lever 50 to slip off of the end of the lever 48. When this occurs, the float 18 will drop with a sudden movement. In so dropping, the slack of the chain 44 is taken up and a jerk is thrown suddenly upon the lever 43 and thence through the link 42 to move the bell-crank lever 41 from under the short supporting lever 40. At the same time, the

slot in the standard 46 moves downward on the pin 47 but does not engage said pin to move the lever 38. This action of dropping does not occur until the chamber 10 is nearly emptied of water.

The inlet openings from the chambers 13 and 14 are somewhat larger than the outlets 51 and 52 with the result that the chambers fill more rapidly than they are emptied.

Referring now to the right hand cylinder or chamber 11, the upward pressure of the float 19 by reason of it being submerged, will be taken up by the pressure of the standard 46^a upon the pin 47^a in the outer end of the lever 38^a. The lever 38^a will not move upward until the float 18 has dropped as previously described for the following reason:—The lever 38^a is connected to the link 37^a and thence through the stem of the valve 24, the lever 28 and the stem of the valve 23 to the lever 36^a in chamber 10. As the pin 39 of this lever 36 rests upon the lever 40 and this lever in turn rests upon the bell-crank lever 41, the pressure upward of the float 19 upon the pin 47^a is not effective to open the valve 24 and close the valve 23 until the dropping of the float 18 moves the support from under the lever 40.

It will be seen from this description that the float 18 acts to release or unlock the apparatus so that the upward pressure of the float 19 may shift the valves 23 and 24 and also as a consequence shift the valves 26 and 27. When the float 19 acts to do this by pressure upward, the float 18 simultaneously acts to assist this movement by its own movement downward. The point to be noticed however is that in the description so far given the float 18 acts to unlock the apparatus so that the valves can be shifted from the position in which they are shown to the alternative position in which open valves are closed and closed valves are opened. It will also be evident that when the level of water is changed in the two chambers 10 and 11, the float 19 will act to unlock this same device in the chamber 11 so that the valves may be again shifted into the position in which they are shown in the drawings. In this shifting operation, the upward movement of the cam surface at the upper corner of the bell-crank 41^a acts to press upward the lever 40^a in case such lever should not normally or readily rise by action of the spring on the upper part of the stem connected to the valve 27. Also in this upward movement the lever 50^a will turn on its pivot so that it can readily pass from below to above the lever 48^a. In coming downward the lever 50^a will catch upon the top of the lever 48^a in the same way as previously described for levers 40, 48 and 50.

Over the tops of the exhaust valves 26 and 27 are perforated hoods 53 and 54. When one of the valves 26 or 27 is open so that

the water will flow inward through the corresponding valve at the bottom the compressed air will expand and flow outward through the open valve 26 or 27 and into the perforated hood over the open valve. The expanded air will flow outward through the perforations in this hood and bubble upward through the water to the surface.

The discharge openings 51 and 52 are connected to upright pipes, one of which is shown at 55 in Fig. 2. Suitable check valves are placed in these pipes for greater convenience than making special valves to be placed in the base 12. These pipes are united to a single pipe and extend to the place where water is to be delivered which we will assume to be at faucets within a residence. Assuming now that a reservoir of compressed air is connected to the pipe 25 and the pump submerged in the bottom of the well, then when the faucet connected to the other end of the discharge pipe 55 is opened, water will flow inward through one of the valves 16 into the corresponding chamber 11 until said chamber is full. Assuming that in the meantime the outlet 51 is communicating with the pipe 55 and that water is going out at the faucet, then when the water has fallen to a level low enough to permit the weight of the float 18 to trip off of the lever 48, the drop of the float will jerk upon the chain 44 and release the locking devices in the chamber 10. This release of the locking devices in the chamber 10 will permit the float 19 to cooperate with the float 18 for shifting the valves from the position shown in the drawings to the alternative position. When this occurs, compressed air from the storage reservoir will enter the chamber 11 to force the water therein out through the opening 52 and at the same time the water will enter through the intake passageway 17 and the intake chamber 13 to the pump chamber 10.

The exhaust air from the pump passing upward through the perforated hood 53 and bubbling through the water in the well has a beneficial result which it is one of the objects of this arrangement to accomplish. Air stored in a reservoir when first compressed is at a comparatively high temperature and as a result of compression this temperature is lost by radiation from the walls of the reservoir and from the pipes through which it is conducted to the pump, and as a consequence, the compressed air in the pump is at a lower temperature than it was at the time it was compressed. When this air expands as a result of being discharged from the pump it falls to a considerable lower temperature, which lower temperature has the effect of cooling the water within the well and making it colder than it would otherwise be. Another effect of bubbling this fresh air through the well water

is to purify the water and keep it sweet and clean. To accomplish these results, the discharge of compressed air is therefore as deep in the well as it is practicable for it to be.

What I claim is:—

1. In a submerged pump, two chambers provided with inlet and outlet openings for air and water, valves for said openings, connections between the valves for the air inlets so that they will operate simultaneously, a supplementary chamber within which said connections are located, a float and valve locking devices in each of the first named chambers, connections from each float to its own inlet valve for opening the same when the locking devices are released by the descent of the other float, restraining devices for preventing such descent until the water is nearly all discharged from the chamber within which the restraining devices are located, and means by which upon release of the restraining devices the sudden descent of the restrained float will release the locking devices by an impulse.

2. In a submerged pump, two chambers provided with inlet and outlet openings for air, valves for said openings, a float and valve locking device in each chamber, connections between each float to its own inlet valve for opening the same by a movement of the float in one direction, other connections from each float for releasing the locking devices of its own chamber by a movement of the float in the opposite direction, and interconnections between the inlet valve of one chamber and the locking devices of the other chamber whereby a releasing movement of the float in said one chamber is a prerequisite to the valve opening movement of the float in the other chamber.

3. In a submerged pump, two chambers provided with inlet and outlet valves for air, a float and valve locking devices in each chamber, connections from each float to the valves and valve locking devices of its own chamber, and interconnections whereby a lock releasing movement of the float in one chamber permits a valve operating movement of the float in the other chamber.

4. In a submerged pump, two chambers provided with inlet and outlet valves for air, a float and valve locking devices in each chamber, means by which the valves are operated by movements of the floats in one direction and the locking devices are released by movements in the opposite direction, interconnections by which the releasing movement of one float permits the valve operating movement of the other float, and means by which such actuating movements are by sudden impulses.

5. In a submerged pump, two chambers

provided with inlet and outlet valves for air, a float and valve locking devices in each chamber, means by which the locking devices and float of one chamber control the fixed position of the valves of both chambers, means by which the shifting of the valves of both chambers is through the action of the float in the other chamber from the one in which the fixed position is controlled, and means by which the release of the locking and the actuation of the valves are by sudden movements of the respective floats.

6. In a submerged pump, means for conveying compressed air to the pump for operating the same, a submerged outlet through which exhaust air is discharged from the pump, and a perforated covering over said discharge for the purpose set forth.

7. In a pump, two chambers provided with inlet and outlet valves for air, a float and valve locking devices in each chamber, connections from each float to the valves and valve locking devices of its own chamber and so arranged that the valves and valve locking devices are operated by float movements in opposite directions, means by which the valve operating movement of a float in one chamber is restrained by the valve locking devices of the other chamber until the float in such other chamber has released the valve locking devices thereof.

Signed at Chicago this 16th day of July 1910.

MARTIN S. SWANSTROM.

Witnesses:

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